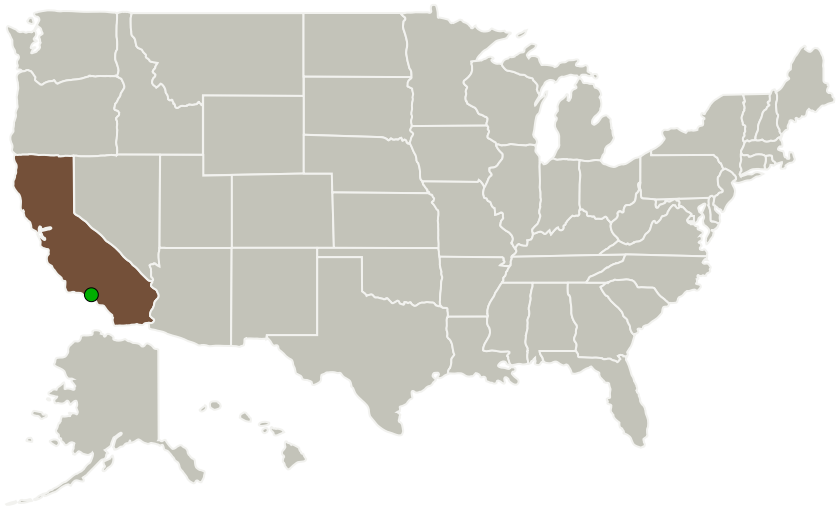
Bringing 3D Memory Cubes to Space: a "Rad-Hard by Design Study" with an Open Architecture, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

The computing capabilities of onboard spacecraft are a major limiting factor for accomplishing many classes of future missions. Although technology development efforts are underway that will provide improvements to spacecraft CPUs, they do not address the limitations of current onboard memory systems. In addition to CPU upgrades, effective execution of data-intensive operations such as terrain relative navigation, hazard detection and avoidance, autonomous planning and scheduling, and onboard science data processing and analysis require high-bandwidth, low-latency memory systems to maximize processor usage (the memory wall) and provide rapid access to observational data captured by high-data-rate instruments (e.g., Hyperspectral Infrared Imager, Interferometric Synthetic Aperture Radar). 3D ICs, after a long wait, is now a reality. The first mainstream product is 3D memory cubes, where multiple memory tiers (4 DRAM tiers as of 2015) are vertically integrated to offer manifold improvement in size, capacity, speed, and power consumption compared with 2D counterparts. Indeed, these are the memory parts that will truly enable aforementioned missions. Unfortunately, none of these are ready for space. The purpose of this research is to investigate the challenges and opportunities in deploying 3D memory cubes into space missions.

Primary U.S. Work Locations and Key Partners



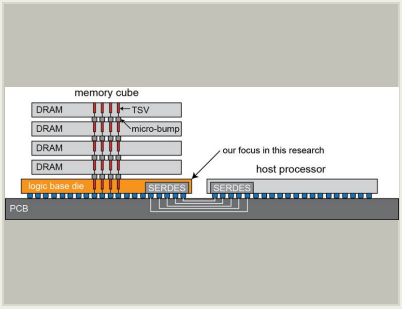


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Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
Irvine Sensors Corporation	Lead Organization	Industry	Costa Mesa, California
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations
California

Project Transitions

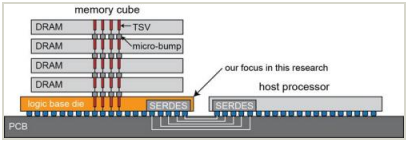
June 2016: Project Start

December 2016: Closed out

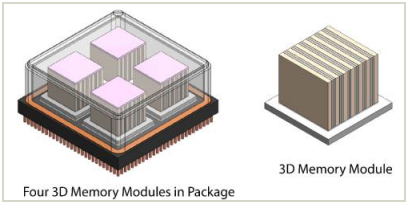
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139765)*

Images



Briefing Chart Image
Bringing 3D Memory Cubes to Space: a "Rad-Hard by Design Study" with an Open Architecture, Phase I
(https://techport.nasa.gov/image/133646)



Final Summary Chart Image
Bringing 3D Memory Cubes to Space: a "Rad-Hard by Design Study" with an Open Architecture, Phase I Project Image
(https://techport.nasa.gov/image/134463)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Irvine Sensors Corporation

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

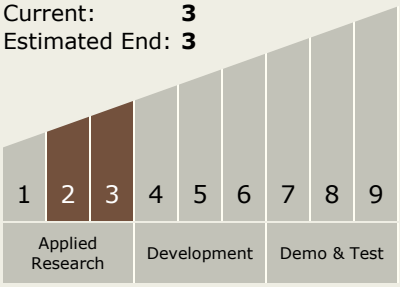
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
James Yamaguchi

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Completed Technology Project (2016 - 2016)

Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.1 Avionics Component Technologies
    - TX02.1.1 Radiation Hardened Extreme Environment Components and Implementations

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System